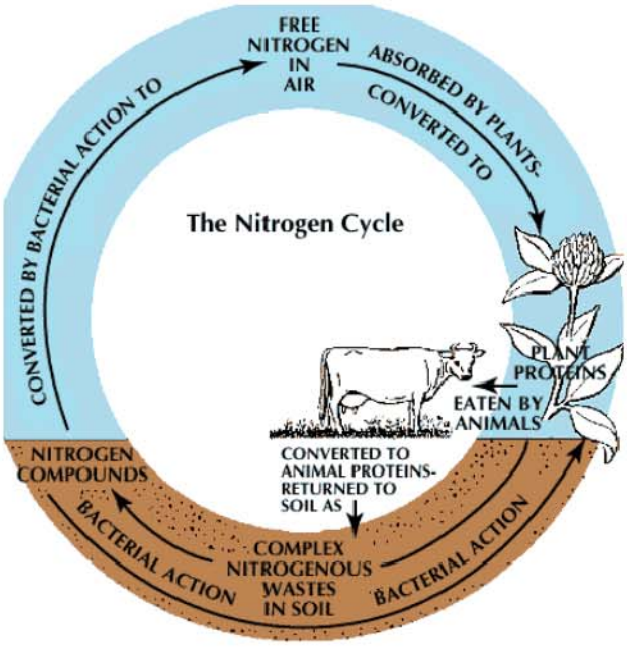
Name: _____ Unit 5: ECOSYSTEMS CLASSWORK: 6.06

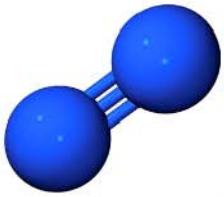


FOCUS: The Nitrogen Cycle

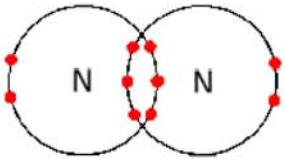
ESSENTIAL QUESTION: Can you describe and explain the various processes involved in the cycling of nitrogen through an ecosystem?

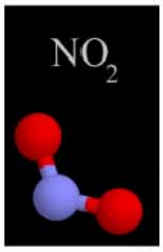
Read the following:

Background Essay: The Nitrogen Cycle



Nitrogen is the most common element in Earth's atmosphere, yet it is also one of the most limiting factors for growth in plants and animals. Most nitrogen exists as a gas. In this common molecule, two nitrogen atoms are bound by a **strong triple bond** that makes them all but completely unavailable to any other atom, ion, compound, or organism. Yet without sufficient levels of available nitrogen, organisms would be unable to create their structures or to perform vital functions. Nitrogen is a key building block in a number of important molecules, such as nucleic acids, amino acids, and proteins. Without it, life as we know it would be impossible.





Two natural forces are responsible for most of the gaseous nitrogen that is "fixed," or made available to, plants and animals. Electricity in the form of lightning is one such force. When a bolt of lightning travels through the atmosphere it breaks the triple bond holding the nitrogen gas molecule together, enabling free nitrogen atoms to bond with oxygen in the air to form nitrogen oxides. These compounds dissolve in atmospheric moisture to form nitrates that then fall as rain.

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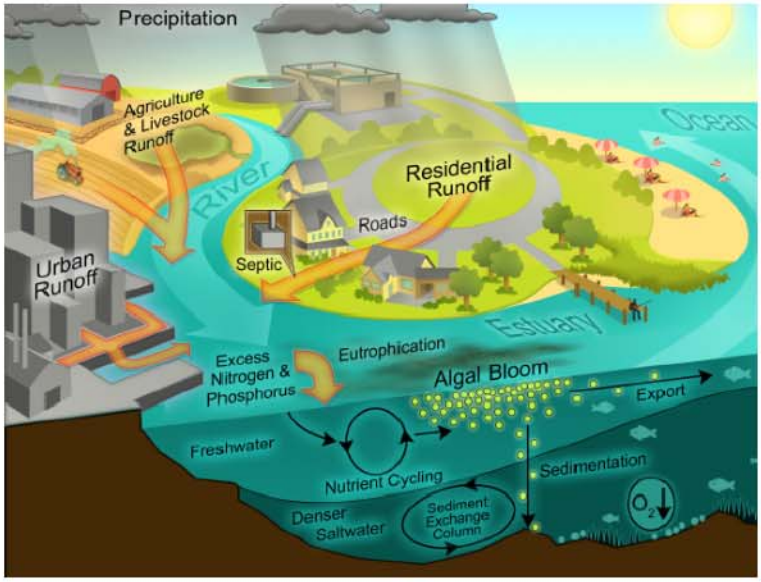
The other force, although less spectacular than lightning, is no less energetic. Countless bacteria, including those living freely in the soil and those found on the roots of some types of plants, fix more than ten times the nitrogen released by lightning strikes. These single-celled organisms break the bonds in nitrogen gas molecules and combine free nitrogen atoms with hydrogen to form ammonium, an ion that is readily absorbed by plants. Some types of nitrogen-fixing bacteria have formed symbiotic relationships with certain types of plants. Legumes, such as peas and beans, support colonies of bacteria called rhizobium, in special structures called nodules, which appear directly on their roots. While the bacteria provide the plants with nitrogen, the plants provide the bacteria with energy-rich carbohydrates and a moist environment in which they can thrive.

Human activities have severely altered the nitrogen levels in some ecosystems. Although nitrogen is typically a limited resource in many environments, it has been made available in massive quantities as a result of agricultural and industrial practices. Sometimes described as "nutrient pollution," the result has often been catastrophic. For instance, when waste such as nitrogen-rich sewage and fertilizers pours into ponds, lakes, and streams, the result is an overabundance of algae (also known as an algal bloom). The eventual death of these microscopic plants leads to their decomposition by bacteria—a process that uses vast quantities of oxygen. Following an algal bloom, decomposing bacteria in lakes and ponds become so abundant and oxygen depletion so complete that fish and other aquatic life may die. This process is called eutrophication.



In the years since scientists discovered this connection, cities and farmers have taken measures to control the flow of nitrogen into ecosystems, so that this powerful element is available at the right quantity where it is needed and less pervasive where it is not.

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DIRECTIONS:

1. For this online interactive activity, you will be studying the role of nitrogen atoms. You will travel through the Nitrogen Cycle and answer questions along your journey.
2. The interactive activity is found at the following address: http://www.teachersdomain.org/resource/lsps07.sci.life.eco.nitrogen/. The link is also found on the 8th grade page of andrewgatt.com.

Interactive Activity: The Nitrogen Cycle

As you complete the Nitrogen Cycle journey, complete the following:

1. In your own words, explain what the following terms mean:
   - **Nitrogen Fixation:**
   - **Ammonification:**
   - **Denitrification:**
   - **Assimilation:**
2. Describe the 2 steps of *Nitrification*.
3. What organisms are responsible for the nitrification process?

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Discussion Questions: The Nitrogen Cycle

Use what you learned in the interactive activity, as well as information gathered from the reading passage, to answer the following questions.

1) The atmosphere is nearly 80% nitrogen in the form of N_2 gas. Why do you think plants and animals can't use nitrogen in the form that it is found in the atmosphere?

2) Explain what is meant by nitrogen fixation. Why is it a necessary part of the Nitrogen Cycle?

3) What is the role of bacteria in the nitrogen cycle? What other organisms are involved in keeping the Nitrogen Cycle going?

4) Why don't legumes (peas, beans, peanuts) need nitrogen-containing fertilizers to grow well?

5) Why is nitrogen so important for living things?